

- 42 -

## CLAIMS

SUB  
AID

1. A method of dispersing an insoluble material in an aqueous solution comprising the following steps:

5

- PM  
524/556  
570
- (i) providing a formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein the second comonomer is selected from the group consisting of  $\beta$ -pinene, 5-ethylidene-2-norbornene, methylene cyclohexane and methylene cyclopentene;

10

- (ii) dispersing said formulation in an aqueous medium.

15

2. A method according to claim 1 wherein the copolymer contains additional comonomer residues which will not substantially change the character of the copolymer.

3. A method of treatment of a substrate with an insoluble material comprising the following steps:

20

- (i) preparing a formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein the second comonomer is selected from the group consisting of  $\beta$ -pinene, 5-ethylidene-2-norbornene, methylene cyclohexane and methylene cyclopentane;

25

30

- 43 -

(ii) dispersing said formulation in an aqueous medium; and

(iii) applying the dispersed formulation to a substrate.

5 4. A method of treatment of a substrate with an insoluble material comprising the following steps:

10 (i) preparing a formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein the second comonomer is selected from the group consisting of limonene and similar terpenes, vinyl cyclohexanes, vinyl cyclohexenes, vinyl pyridines, vinyl thiophenes, vinyl naphthalenes, vinyl furans, vinyl pyrans and vinyl pyrrolidones;

15 (ii) dispersing said formulation in an aqueous medium; and

20 (iii) applying the dispersed formulation to a substrate.

5. A method of treatment of a substrate with an insoluble material comprising the following steps:

25 (i) preparing a formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein the second comonomer is an  $\alpha$ -olefin having an alkyl group selected from the group consisting of diisobutylene, isobutylene, n-octene, n-decene, allylglycidylether or

30

- 44 -

vinylisobutylether;

- (ii) dispersing said formulation in an aqueous medium; and
- 5 (iii) applying the dispersed formulation to a substrate.
6. A method of treatment of a substrate with an insoluble material comprising the following steps:
- 10 (i) preparing a formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein
- 15 at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and
- 20 optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents, wherein said comonomer is in free acid form;
- 25 (ii) dispersing said formulation in an aqueous medium; and
- (iii) applying the dispersed formulation to a substrate.
- 30 7. A method of treatment of a substrate with an insoluble material comprising the

- 45 -

following steps:

- 5 (i) preparing a formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents, wherein the dispersant is a water-soluble agriculturally acceptable derivative of the copolymer wherein said derivative is selected from the group consisting of polyalkyleneoxy derivatives, polyethyleneglycol derivatives, polyamide derivatives and polyvinyl alcohol derivatives;
- 10
- 15
- 20 (ii) dispersing said formulation in an aqueous medium; and
- (iii) applying the dispersed formulation to a substrate.

25 8. A method of treatment of a substrate with an insoluble material comprising the following steps:

- (i) preparing a formulation comprising at least one insoluble material, a surfactant wetting agent and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second
- 30

- 46 -

comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents;

(ii) dispersing said formulation in an aqueous medium; and

(iii) applying the dispersed formulation to a substrate.

8. A method of dispersing active water-insoluble agrochemical principal in an aqueous solution comprising the following steps:

(i) providing a formulation comprising at least one active water-insoluble agrochemical principal and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic

5 (ii) dispersing said formulation in an aqueous medium.

15

20 12. A method according to claim 9 wherein the second comonomer is selected from the group consisting of substituted and unsubstituted norbornene, cyclopentadiene and substituted cyclopentadienes, substituted and unsubstituted dicyclopentadienes, cyclohexenes, furans and indenes.

25 13. A method according to claim 9 wherein the second comonomer is selected from the group consisting of limonene and similar terpenes, vinyl cyclohexanes, vinyl cyclohexenes, vinyl pyridines, vinyl thiophenes, vinyl naphthalenes, vinyl furans, vinyl pyrans and, vinyl pyrrolidones.

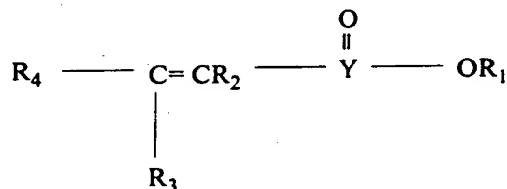
30 14. A method according to claim 9 wherein the second comonomer is an  $\alpha$ -olefin

- 48 -

having an alkyl group selected from the group consisting of diisobutylene, isobutylene, n-octene, n-decene, allyglycidylether or vinylisobutylether.

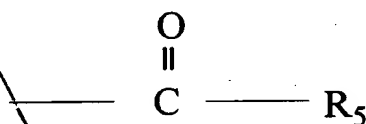
Sub  
A12  
5

15. A method according to claim 9 wherein the first comonomer has a structure I



I

wherein  $\text{R}_1$  is a metal, quaternary ammonium, phosphonium or sulphonium residue,  $\text{R}_2$  is hydrogen or  $\text{C}_1$  to  $\text{C}_4$  alkyl, Y is a carbon atom,  $\text{O}=\text{S}$ , or  $\text{POR}$  where R is a hydrogen atom or alkyl radical having from 1 to 10 carbon atoms (or carboxylated such radical) and  $\text{R}_4$  is H, an alkyl radical or a carboxylic acid derivative of formula II



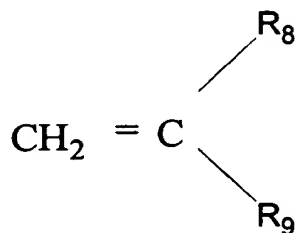
II

15 wherein  $\text{R}_5$  is  $\text{OR}_6$ ,  $\text{NR}_6\text{R}_7$  or  $\text{SR}_6$ ,

wherein  $\text{R}_6$  and  $\text{R}_7$  are H, alkyl, O-alkyl, or alkyl groups with a hetero atom substituent.

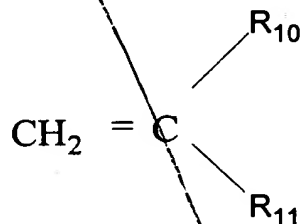
16. A method according to claim 9 wherein the second comonomer is a vinyl  
20 compound of formula III

- 49 -



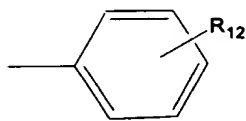
III

5 wherein  $\text{R}_8$  represents hydrogen, a straight or branched chain alkyl of from 1-4 carbon atoms,  $\text{R}_9$  represents hydrogen, a branched chain alkyl radical of from 1-12 carbon atoms, 10 or cycloalkyl radical, and/or a vinyl compound of formula IV

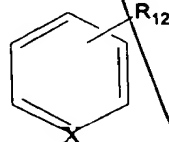


IV

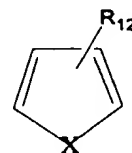
15 wherein  $\text{R}_{10}$  is a straight or branched chain alkyl radical of from 1-4 carbons and  $\text{R}_{11}$  is given by formula V, VI or VII,



V



VI



VII

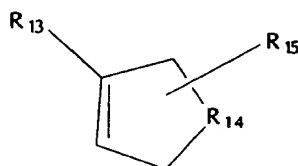
20



- 50 -

wherein  $R_{12}$  represents one or more alkyl radicals or one or more of H, Cl, OR and  $SO_3R_1$ ,  $NO_2$ ,  $PO_3R_1$  and X is a hetero atom other than carbon; and/or an olefin shown by formula VIII,

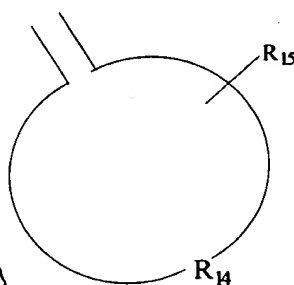
5



VIII

wherein  $R_{13}$  is Cl,  $SO_3R_1$ , alkyl, O-alkyl or O-aryl, and  $R_{14}$  represents from 4-20 carbon atoms such as to make a cyclic or polycyclic alkane or polyalkenyl compound,  $R_{15}$  is an  
10 epoxide or  $SO_3R_1$  reacted with an unsaturated portion of the ring comprising  $R_{14}$ ; and/or an exocyclic olefin shown by formula IX

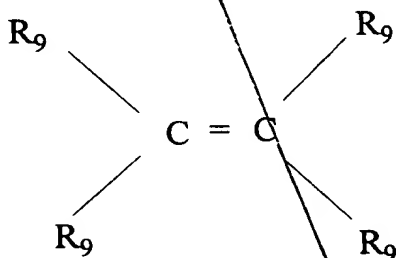
15



IX

20

and/or an internal olefin shown by formula X,



X

- 51 -

where  $R_9$  is the same or different and as hereinabove defined.

17. A method according to claim 9 wherein the copolymer contains additional comonomer residues which will not substantially change the character of the copolymer.

5  
18. An agricultural formulation comprising at least one insoluble material and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha, \beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents.

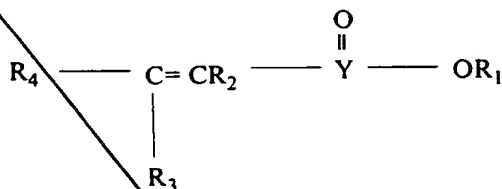
19. An agricultural formulation according to claim 18 wherein the formulation is in the form of a suspension concentrate (SC), a wettable powder (WP) or a water dispersible granule (WG).

20. An agricultural formulation according to claim 18 wherein first comonomers are selected from the group consisting of fumaric acid, maleic acid and anhydrides, and the esters, amides and imides derived from them, itaconic acid and anhydride and the corresponding esters amides and imides derived from them, acrylic and methacrylic acids and the esters and amides derived from them, vinylphosphonic acid and the corresponding esters and amides derived from it and ethylene sulphonic acid and the esters and amides derived from it.

30

- 52 -

21. An agricultural formulation according to claim 18 wherein the second comonomers are selected from the group consisting of  $\beta$ -pinene, 5-ethylidene-2-norbornene, methylene cyclohexane and methylene cyclopentane.
- 5 22. An agricultural formulation according to claim 18 wherein the second comonomers are selected from the group consisting of substituted and unsubstituted norbornene, cyclopentadiene and substituted cyclopentadienes, substituted and unsubstituted dicyclopentadienes, cyclohexenes, furans and indenenes.
- 10 23. An agricultural formulation according to claim 18 wherein the second comonomers are selected from the group consisting of limonene and similar terpenes, vinyl cyclohexanes, vinyl cyclohexenes, vinyl pyridines, vinyl thiophenes, vinyl naphthalenes, vinyl furans, vinyl pyrans and, vinyl pyrrolidones.
- 15 24. An agricultural formulation according to claim 18 wherein the first comonomers are selected from the group consisting of an  $\alpha$ -olefin having an alkyl group selected from the group consisting of diisobutylene, isobutylene, n-octene, n-decene, allylglycidylether or vinylisobutylether.
- 20 25. An agricultural formulation according to claim 18 wherein the first comonomers are selected from the group consisting of structure I



25

wherein  $\text{R}_1$  is a metal, quaternary ammonium, phosphonium or sulphonium residue,  $\text{R}_2$  is hydrogen or  $\text{C}_1$  to  $\text{C}_4$  alkyl, Y is a carbon atom,  $\text{O}=\text{S}$ , or POR where R is a hydrogen

- 53 -

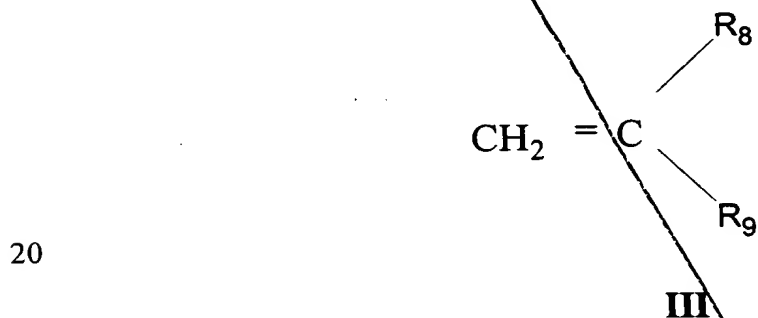
atom or alkyl radical having from 1 to 10 carbon atoms (or carboxylated such radical) and  $R_4$  is H, an alkyl radical or a carboxylic acid derivative of formula II



10 wherein  $R_5$  is  $OR_6$ ,  $NR_6R_7$  or  $SR_6$ ,

wherein  $R_6$  and  $R_7$  are H, alkyl, O-alkyl, or alkyl groups with a hetero atom substituent.

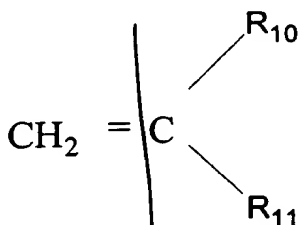
26. An agricultural formulation according to claim 18 wherein the first comonomer is  
15 selected from the group consisting of III



wherein  $R_8$  represents hydrogen, a straight or branched chain alkyl of from 1-4 carbon atoms,  $R_9$  represents hydrogen, a branched chain alkyl radical of from 1-12 carbon atoms, or a cycloalkyl radical, and/or a vinyl compound of formula IV

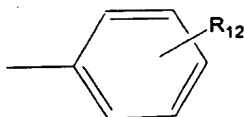
25

- 54 -

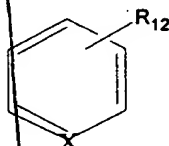


IV

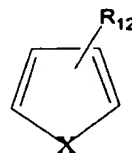
wherein  $\text{R}_{10}$  is a straight or branched chain alkyl radical of from 1-4 carbons and  $\text{R}_{11}$  is given by formula V, VI or VII,



V

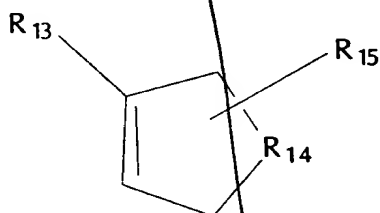


VI



VII

wherein  $\text{R}_{12}$  represents one or more alkyl radicals or one or more of H, Cl, OR and  $\text{SO}_3\text{R}$ ,  $\text{NO}_2$ ,  $\text{PO}_3\text{R}$  and X is a hetero atom other than carbon; and/or an olefin shown by formula VIII,



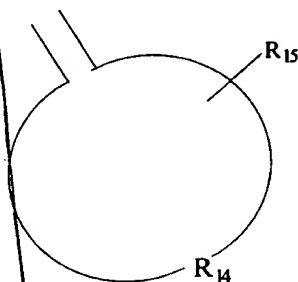
VIII

wherein  $\text{R}_{13}$  is Cl,  $\text{SO}_3\text{R}$ , alkyl, O-alkyl or O-aryl, and  $\text{R}_{14}$  represents from 4-20 carbon atoms such as to make a cyclic or polycyclic alkane or polyalkenyl compound,  $\text{R}_{15}$  is an

- 55 -

epoxide or  $\text{SO}_3\text{R}_1$  reacted with an unsaturated portion of the ring comprising  $\text{R}_{14}$ ;  
and/or an exocyclic olefin shown by formula IX

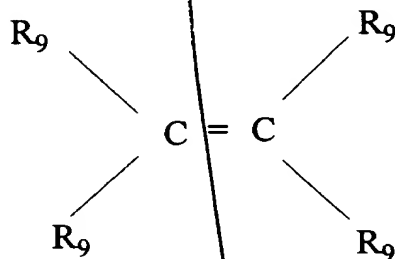
5



10

**IX**

and/or an internal olefin shown by formula X,



15

**X**

where  $\text{R}_9$  is the same or different and as hereinabove defined.

27. An agricultural formulation according to claim 18 wherein the copolymer contains  
20 additional comonomer residues which will not substantially change the character of the  
copolymer.

28. An agricultural formulation according to claim 18 wherein the dispersant is readily

- 56 -

soluble in water.

29. An agricultural formulation according to claim 18 wherein the dispersant is an agriculturally acceptable salt of the copolymer and wherein the salt comprises sodium, potassium and/or ammonium ions.

30. An agricultural formulation according to claim 18 wherein the copolymer is polyanionic.

31. An agricultural formulation according to claim 18 wherein the copolymer is in the form of its free acid.

32. An agricultural formulation according to claim 18 wherein the dispersant is a water-soluble agriculturally acceptable derivative of the copolymer wherein said derivative is selected from the group consisting of polyalkyleneoxy derivatives, polyethyleneglycol derivatives, polyamide derivatives and polyvinyl alcohol derivatives.

33. An agricultural formulation according to claim 18 wherein copolymers are in the range of from 1000 to 90000 daltons.

20

34. An agricultural formulation according to claim 18 wherein the water-insoluble materials are selected from the group consisting of herbicides, insecticides, fungicides, biocides, molluscicides, algaicides, plant growth regulators, anthelmintics, rodenticides, nematocides, acaricides, amoebicides, protozoacides, fertilizers, crop safeners, fillers and carriers and other adjuvants.

35. An agricultural formulation according to claim 18 wherein the formulation further comprises a surfactant wetting agent.

36. An agricultural formulation according to claim 35 wherein the surfactant wetting

- 57 -

agent is selected from the group consisting of an alkylpolysaccharide; di or mono alkyl sulphosuccinate derivative; a nonionic surfactant loaded onto an inert silicate carrier; and a non-ionic surfactant delivered in the form of a urea surfactant complex.

37. A method of making an agrochemical formulation comprising the steps of:

- (i) combining at least one insoluble material, and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents.

38. A method according to claim 37 comprising the steps of:

- (i) combining at least one insoluble material, and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents



- 58 -

and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents;

(ii) milling said combination to a particle size range in order to obtain a stable, readily-suspendible aqueous dispersion; and

(iii) stabilising said aqueous dispersion to obtain an SC formulation suitable for dilution in water for agricultural use.

38. A method according to claim 37 comprising the steps of:

(i) combining at least one insoluble material, with at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents; and

(ii) milling said combination to a desired particle size to obtain a homogeneous wettable powder (WP) formulation.

- 59 -

40  
39. A method according to claim 37 comprising the steps of:

- 5 (i) combining at least one insoluble material suitable for agricultural use with at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, 10 wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said 15 optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents; and
- 20 (ii) blending said combination to obtain a homogeneous wettable powder (WP) formulation.

40. A method according to claim 37 comprising the steps of:

- 25 (i) combining at least one insoluble material suitable for agricultural use with at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, 30 wherein the substituents for said first comonomer are selected from the group

- 60 -

consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents;

- (ii) agglomerating said combination to form discrete granular materials; and
- 10 (iii) drying said granular materials to obtain a water dispersible granule WG formulation.

42  
41. A method according to claim 37 wherein the first comonomers are selected from the group consisting of fumaric acid, maleic acid and anhydrides, and the esters, amides and imides derived from them, itaconic acid and anhydride and the corresponding esters amides and imides derived from them, acrylic and methacrylic acids and the corresponding esters and amides derived from them, vinylphosphonic acid and the corresponding esters and amides derived from it and ethylene sulphonic acid and the esters and amides derived from it.

20 43  
42. A method according to claim 37 wherein the second comonomer is selected from the group consisting of  $\beta$ -pinene, 5-ethylidene-2-norbornene, methylene cyclohexane and methylene cyclopentane.

25 44  
43. A method according to claim 37 wherein the second comonomer is selected from the group consisting of substituted and unsubstituted norbornene, cyclopentadiene and substituted cyclopentadienes, substituted and unsubstituted dicyclopentadienes, cyclohexenes, furans and indenenes.

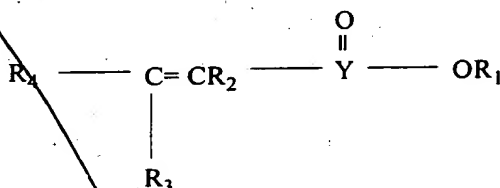
30 45  
44. A method according to claim 37 wherein the second comonomer is selected from

- 61 -

the group consisting of limonene and similar terpenes, vinyl cyclohexanes, vinyl cyclohexenes, vinyl pyridines, vinyl thiophenes, vinyl naphthalenes, vinyl furans, vinyl pyrans and vinyl pyrrolidones.

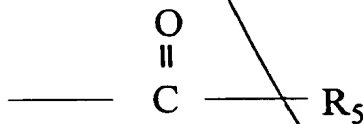
45 A method according to claim 37 wherein the second comonomer is an  $\alpha$ -olefin having an alkyl group selected from the group consisting of diisobutylene, isobutylene, n-octene, n-decene, allylglycidylether or vinylisobutylether.

46 A method according to claim 37 wherein the first comonomer has a structure I



I

wherein  $\text{R}_1$  is a metal, quaternary ammonium, phosphonium or sulphonium residue,  $\text{R}_2$  is hydrogen or  $\text{C}_1$  to  $\text{C}_4$  alkyl, Y is a carbon atom,  $\text{O}=\text{S}$ , or  $\text{POR}$  where R is a hydrogen atom or alkyl radical having from 1 to 10 carbon atoms (or carboxylated such radical) and  $\text{R}_4$  is H, an alkyl radical or a carboxylic acid derivative of form II



II

wherein  $\text{R}_5$  is  $\text{OR}_6$ ,  $\text{NR}_6\text{R}_7$ ,  $\text{SR}_6$ ,

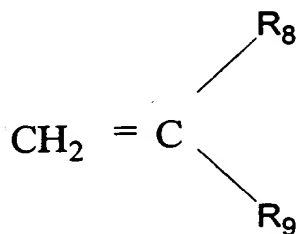
- 62 -

wherein  $R_6$  and  $R_7$  are H, alkyl, O-alkyl, or alkyl groups with a hetero atom substituent.

48  
47.

A method according to claim 37 wherein the second comonomer has a structure III

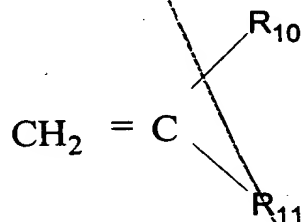
5



III

wherein  $R_8$  represents hydrogen, a straight or branched chain alkyl of from 1-4 carbon atoms,  $R_9$  represents hydrogen, a branched chain alkyl radical of from 1-12 carbon atoms, or a cycloalkyl radical,

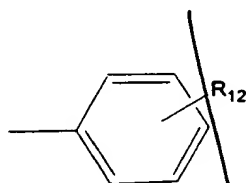
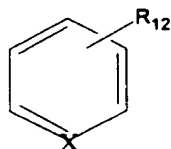
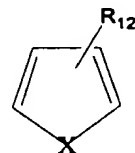
10 and/or a vinyl compound of formula IV



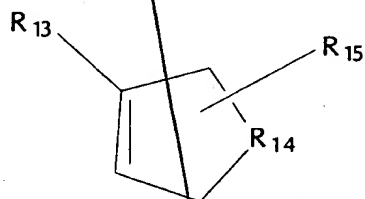
IV

wherein  $R_{10}$  is a straight or branched chain alkyl radical of from 1-4 carbons and  $R_{11}$  is  
15 given by formula V, VI or VII,

- 63 -

**V****VI****VII**

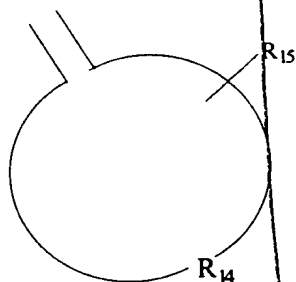
wherein  $R_{12}$  represents one or more alkyl radicals or one or more of H, Cl, OR and  $SO_3R_1$ ,  
 5  $NO_2$ ,  $PO_3R_1$  and X is a hetero atom other than carbon; and/or an olefin shown by formula  
 VIII,

**VIII**

10

wherein  $R_{13}$  is Cl,  $SO_3R_1$ , alkyl, O-alkyl or O-aryl, and  $R_{14}$  represents from 4-20 carbon  
 atoms such as to make a cyclic or polycyclic alkane or polyalkenyl compound,  $R_{15}$  is an  
 epoxide or  $SO_3R_1$  reacted with an unsaturated portion of the ring comprising  $R_{14}$ ;

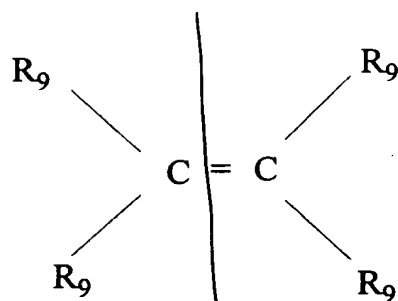
15 and/or an exocyclic olefin shown by formula IX

**IX**

and/or an internal olefin shown by formula X,

20

- 64 -



where R<sub>9</sub> is the same or different and as hereinabove defined.

5

49  
48.

A method according to claim 37 wherein the copolymer contains additional comonomer residues which will not substantially change the character of the polymer.

50  
49.

A method according to claim 37 wherein the dispersant is readily soluble in water.

10

51  
50.

A method according to claim 37 wherein the dispersant is an agriculturally acceptable salt of the copolymer and wherein the salt comprises sodium, potassium and/or ammonium ions.

15 51.

A method according to claim 37 wherein the copolymer is polyanionic.

52  
52.

A method according to claim 37 wherein the copolymer is in the form of its free acid.

53  
53.

A method according to claim 37 wherein the dispersant is a water-soluble agriculturally acceptable derivative of the copolymer wherein said derivative is selected from the group consisting of polyalkyleneoxy derivatives, polyethyleneglycol derivatives, polyamide derivatives and polyvinyl alcohol derivatives.

54  
54.

A method according to claim 37 wherein copolymers are in the range of from 1000

- 65 -

to 90000 daltons.

<sup>56</sup>  
55. A method according to claim 37 wherein the water-insoluble materials are selected from the group consisting of herbicides, insecticides, fungicides, biocides, molluscicides, 5 algaicides, plant growth regulators, anthelmintics, rodenticides, nematocides, acaricides, amoebicides, protozoacides, fertilizers, crop safeners, fillers and carriers and other adjuvants.

<sup>57</sup>  
56. An agricultural formulation produced by the method of any one of claims 37 to 40.

<sup>58</sup>  
57. A method of treatment of a substrate with an active water-insoluble agrochemical principal comprising the following steps:

- (i) preparing a formulation comprising at least one active water-insoluble agrochemical principal and at least one dispersant comprising a copolymer wherein said copolymer comprises a residue of a first comonomer and a residue of a second comonomer, wherein said first comonomer is an  $\alpha,\beta$ -unsaturated oxyacid or anhydride and said second comonomer is an olefin having at least one polymerizable double bond and wherein at least one of said first comonomer and said second comonomer is substituted, wherein the substituents for said first comonomer are selected from the group consisting of esters, amides, thioesters and functional groups derived from reaction with nucleophilic reagents and wherein the substituents for the second comonomer are selected from the group consisting of epoxides; sulfonates; esters; amides; and optionally substituted pendent aromatic and heteroaromatic groups wherein said optional substituents are selected from the group consisting of sulfonates, nitrates, phosphates and other substituents derived from reaction with electrophilic reagents;

- (ii) dispersing said formulation in an aqueous medium; and

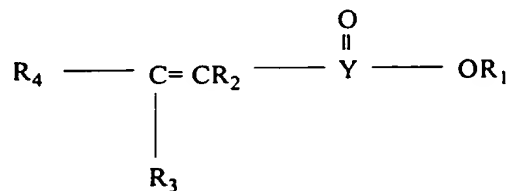


- 66 -

(iii) applying the dispersed formulation to a substrate.

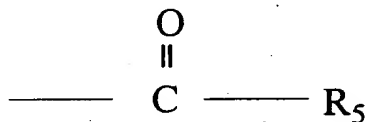
- <sup>59</sup>  
~~58.~~ A method according to claim 57 wherein the first comonomers are selected from the group consisting of fumaric acid, maleic acid and anhydrides, and the esters, amides and imides derived from them, itaconic acid and anhydride and the corresponding esters amides and imides derived from them, acrylic and methacrylic acids, esters and amides, vinylphosphonic acid and the corresponding esters and amides derived from it and ethylene sulphonic acid and the esters and amides derived from it.
- 10 <sup>60</sup>  
~~59.~~ A method according to claim 57 wherein the second comonomer is selected from the group consisting of  $\beta$ -pinene, 5-ethylidene-2-norbornene, methylene cyclohexane and methylene cyclopentane.
- <sup>61</sup>  
~~60.~~ A method according to claim 57 wherein the second comonomer is selected from 15 the group consisting of substituted and unsubstituted norbornene, cyclopentadiene and substituted cyclopentadienes, substituted and unsubstituted dicyclopentadienes, cyclohexenes, furans and indenenes.
- <sup>62</sup>  
~~61.~~ A method according to claim 57 wherein the second comonomer is selected from 20 the group consisting of limonene and similar terpenes, vinyl cyclohexanes, vinyl cyclohexenes, vinyl pyridines, vinyl thiophenes, vinyl naphthalenes, vinyl furans, vinyl pyrans and, vinyl pyrrolidones.
- <sup>63</sup>  
~~62.~~ A method according to claim 57 wherein the second comonomer is an  $\alpha$ -olefin 25 having an alkyl group selected from the group consisting of diisobutylene, isobutylene, n-octene, n-decene, allylglycidylether or vinylisobutylether.
- <sup>64</sup>  
~~63.~~ A method according to claim 57 wherein the first comonomer has a structure I

- 67 -



I

wherein  $\text{R}_1$  is a metal, quaternary ammonium, phosphonium or sulphonium residue,  $\text{R}_2$  is hydrogen or  $\text{C}_1$  to  $\text{C}_4$  alkyl, Y is a carbon atom, O=S, or POR where R is a hydrogen  
 5 atom or alkyl radical having from 1 to 10 carbon atoms (or carboxylated such radical) and  $\text{R}_4$  is H, an alkyl radical or a carboxylic acid derivative of formula II



II

10 wherein  $\text{R}_5$  is  $\text{OR}_6$ ,  $\text{NR}_6\text{R}_7$ ,  $\text{SR}_6$ ,

wherein  $\text{R}_6$  and  $\text{R}_7$  are H, alkyl, O-alkyl, or alkyl groups with a hetero atom substituent.

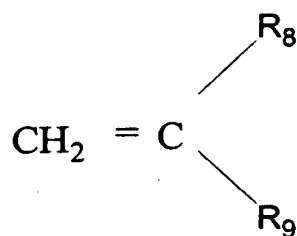
15

20

- 68 -

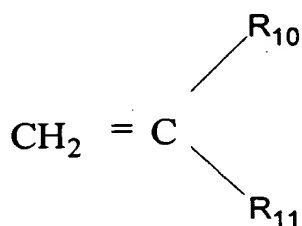
65.  
64.

A method according to claim 57 wherein the second comonomer has a structure III



## III

- 5 wherein  $\text{R}_8$  represents hydrogen, a straight or branched chain alkyl of from 1-4 carbon atoms,  $\text{R}_9$  represents hydrogen, a branched chain alkyl radical of from 1-12 carbon atoms, or a cycloalkyl radical, and/or a vinyl compound of formula IV

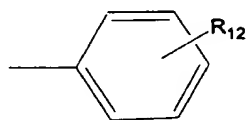


## IV

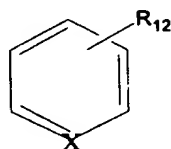
10

wherein  $\text{R}_{10}$  is a straight or branched chain alkyl radical of from 1-4 carbons and  $\text{R}_{11}$  is given by formula V, VI or VII,

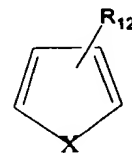
15



V



VI

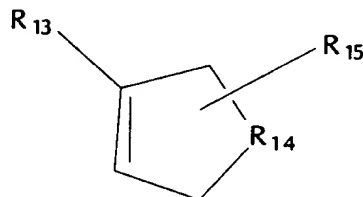


VII

- 69 -

wherein  $R_{12}$  represents one or more alkyl radicals or one or more of H, Cl, OR and  $SO_3R_1$ ,  $NO_2$ ,  $PO_3R_1$  and X is a hetero atom other than carbon; and/or an olefin shown by formula VIII,

5

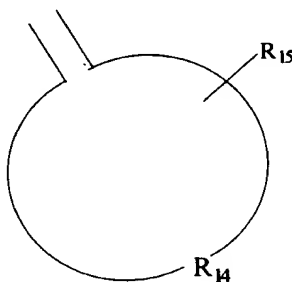


10

**VIII**

wherein  $R_{13}$  is Cl,  $SO_3R_1$ , alkyl, O-alkyl or O-aryl, and  $R_{14}$  represents from 4-20 carbon atoms such as to make a cyclic or polycyclic alkane or polyalkenyl compound,  $R_{15}$  is an epoxide or  $SO_3R_1$  reacted with an unsaturated portion of the ring comprising  $R_{14}$ ;

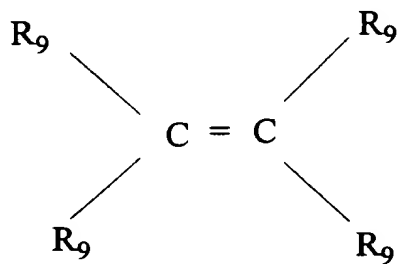
15 and/or an exocyclic olefin shown by formula IX

**IX**

and/or an internal olefin shown by formula X,

20

- 70 -

**X**

where R<sub>9</sub> is the same or different and as hereinabove defined.

5